Models AM-44 and AM-42 (Bell Versions)
Models AM-42E and AM-44E (CCITT Versions)
Personal V.F. Transmission Test Set

INSTRUCTION MANUAL

Ameritec
CORPORATION

MODELS AM-44 and AM-42 (Bell Versions)
MODELS AM-42E and AM-44E (CCITT Versions)
PERSONAL V.F. TRANSMISSION TEST SET

INSTRUCTION MANUAL

July 1991

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I. INTRODUCTION

This instruction manual describes the Ameritec Model AM-42, AM-44 AM-42E and AM-44E Personal V.F. Test Sets and their operation.

The Model AM-44 and AM-42 are North American versions complying with Bell System Technical Reference BSTR 41009.

The Model AM-44E and AM-42E are world versions complying with CCITT recommendations.

Detailed feature differences are given in the "TECHNICAL SPECIFICATIONS" section of this manual, starting on Page 36.

II. RECEIVING/UNPACKING

The AM-4 series unit was thoroughly tested and carefully packed before shipment and was in good condition when turned over to the carrier for transport.

Upon receipt, thoroughly inspect the outside of the shipping container for damage. If the container is damaged, and the AM-4 is found to be damaged or non operational, immediately contact the carrier and submit a claim for damages.

The name of the carrier will be noted on the packing slip which accompanied the shipment.

Each AM-4 series unit is shipped with the following:

1 - AM-4 series unit
4 - AA size alkaline batteries
1 - Modular input cord with minigator clip end
1 - Battery eliminator AC adaptor
1 - Instruction manual
1 - Plastic transport case

III. ACCEPTANCE TEST

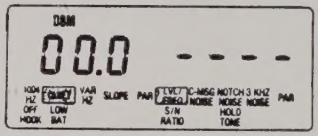
To verify proper operation of the unit, carefully follow these steps:

1. Install 4 AA size batteries (provided with unit) in accordance with the instructions on page 18 of this manual.

> CAUTION: Pay special attention to installing batteries in the proper polarity. Backward installation of the batteries may result in damage to the unit. Operator damage of this type is not covered by the warranty.

2. Place the TERM/BRDG switch in TERM, 600 ohm/900 ohm switch in 600 ohm, 2W/4W/4W REV in 4W.

3. Depress the "ON" rocker switch. Place the ABS/REL/GEN in the GEN position.
The display should now indicate:



4. Use the SEND SEL rocker switch to position the SEND menu cursor behind the 1004HZ (820HZ for AM44E or AM42E version) menu item.

5. Place the MON SND/MON RCV/TALK Rocker Switch in the MON SND Position and increase the volume control.
The internal speaker should emit a 1004HZ (820HZ for AM44E or AM42E version) tone and the display should indicate 00.0 dBm, 1004HZ (820HZ for AM44E or AM42E version).

6. Place the ON HK/DP/TONE Rocker Switch in the TONE position. (AM-44 or AM-44E) or the HOLD/DIAL Switch in the HOLD Position (AM-42 or AM-42E). Place the DTMF/MF switch in the DTMF position (AM-44 or AM-44E).
The OFF HK annunciator on the display should come on.

7. Depress any one of the 16 keypad buttons. (AM-44 or AM-44E)
The speaker should emit the appropriate DTMF (touch tone) frequency as long as a key is held depressed. When the key is released the send annunciator should have moved to QUIET.

8. Move the SEND annunciator back to 1004HZ (820HZ for AM-44E or AM-42E version) by using the "SEND SEL" rocker switch. Insert the provided line cable in the modular jack in the base of the unit and clip the following leads together:
Red to Yellow
Green to Black
Move the ABS/REL/GEN rocker switch to the ABS position.
The display should indicate the same as in the GEN position except the level reading may indicate -00.2 to 00.2.

Remove the line cord.

The display should indicate "UNDR" in place of the level measurement and the "1004" (820HZ for AM-44E or AM-42E version) reading should disappear.

9. Use the MEASURE SEL rocker switch to move the measure cursor to C MSG NOISE (AM44 or AM42) or "PSHO NOISE" (AM-44E or AM-42E) and replace the line cord.

The display should indicate 90 ± 1 dBrnc on AM-44 or AM-42.

The display should indicate 00 ± 1 dBm on AM-44E or AM-42E.

Although the above tests are not all encompassing, they do serve to verify the basic functionality of the unit.

IV. PRODUCT DESCRIPTION

A. GENERAL

The Ameritec Model AM-4 Series Personal V.F. Test Set is a hand-held telecommunications transmission test set designed to make analog telephone transmission measurements in accordance with Bell Publication 41009 or CCITT recommendation. The unit contains both a signal generator and measurement capability and operates in the telephone voice band (IE 200HZ to 5KHZ, measure capability to 10KHZ). The unit is compatible with both two wire and four wire telephone circuits and can be used on either private lines or switched access lines. Capabilities are listed below:

SIGNAL GENERATOR SECTION	MEASUREMENT SECTION
2713HZ Momentary	Level
1004HZ (820HZ***)	Frequency
Quiet termination	C-message Noise
Variable frequency (200HZ-5KHZ)	(psophometric
P/AR Send*	noise***)
Slope tones	Notch noise
DTMF**	3KHZ noise
MF**	S/N ratio
Dial Pulse**	P/AR Measure*

*AM-44 Only
**AM-44 & AM-44E Only (versions with dial keypad)
***AM44E & AM42E only (CCITT versions)

The generator and measurement functions may be operated simultaneously for full duplex operation.
The system is based on digital circuit design employing dual 8048 microprocessors with CMOS EPROM program store. All integrated circuits are CMOS for low power consumption. The measurements are displayed on a custom liquid crystal display which also contains operating mode annunciators. Because of the all digital design there are no calibration adjustments and the unit will maintain specified accuracy during its entire life.

B. PHYSICAL

All components are mounted on three interlocking printed circuit boards which are housed within a high impact injection molded ABS plastic case. The case is factory sealed as there are no user serviceable parts inside.

The unit, with batteries, weighs 26 ounces and measures 4.2"x7.6"x1.7" (106mm x 193mm x 43mm).

All unit controls are in the form of rocker switches and slide switches, and are located along the left and right sides of the unit. The controls are protected from abuse by integral "RIBS" molded into the sides of the case. Line connections and accessory battery eliminator connection are made at the base of the unit.

Battery access is provided through a rear slide door.

A hinged wire bail with two detent positions is provided as part of the case to facilitate "standing" and "hanging" the unit.

The rear panel of the unit contains a "quick reference" operating guide.

C. DISPLAY

The unit contains a liquid crystal display (LCD). The display is used to indicate the result of measurements and will simultaneously display level and frequency. The display also contains "send" and "measure" menus to indicate mode of operation.

LEVEL: A 3 1/2 Digit .3" LCD which displays the absolute or relative level of the received signal or the absolute level of the send (GEN) signal depending upon the position of the ABS/REL/GEN switch. The appropriate units of measurement (dBm, dB, dBrel, dBrn and dBrnc) are automatically indicated by appropriate indicators directly above the level reading.

FREQUENCY: A 4 digit .3" LCD which displays the absolute frequency of the received signal or the absolute frequency of the send (GEN) signal depending upon the position of the ABS/REL/GEN switch. All frequency measurements are displayed in Hertz (HZ) with resolution to 1HZ.

SEND MENU: The send menu consists of five printed menu items (four on the AM-42, AM-42E and AM-44E) located in the lower left quadrant of the display and color coded yellow. A single moveable rectangle (cursor) will appear behind one of these items, when the unit is "on", to indicate the internal signal generator output mode. The cursor may be moved behind the desired menu item by activation of the SEND SEL rocker switch. The send menu items are:

MODEL		
AM-44	AM-42	AM-42E AM-44E
1004HZ	1004HZ	820HZ
QUIET	QUIET	QUIET
VAR HZ	VAR HZ	VAR HZ
SLOPE	SLOPE	SLOPE
P/AR		

MEASURE MENU: The measure menu consists of six preprinted menu items (five on the AM-42, AM-42E and AM-44E) located in the lower right quadrant of the display and color coded red. A single moveable rectangle (cursor) will appear behind one of these items when the unit is "on" to indicate the internal measurement mode status. The cursor may be moved behind the desired menu item by activation of the MEASURE SEL rocker switch.

The measure menu items are:

MODEL		
AM-44	AM-42	AM-42E -OR AM-44E
LVL/FREQ	LVL/FREQ	LVL/FREQ
C-MSG Noise	C-MSG Noise	Psophometric
Notch Noise	Notch Noise	Noise
3KHZ Noise	3KHZ Noise	Notch Noise
S/N Ratio	S/N Ratio	3KHZ NOISE
P/AR		S/N Ratio

OFF HOOK INDICATOR: A legend located in the lower left quadrant of the display. An LCD rectangle will illuminate behind the legend whenever the internal DC line hold circuit is switched across the SEND pair. (AM-44 or AM-44E ON HK/DP/TONE switch in DP or DTMF position) (AM-42 or AM-42E HOLD/DIAL switch in HOLD position)

LOW BAT INDICATOR: A legend located in the lower left quadrant of the display. An LCD rectangle will illuminate behind the legend whenever the internal 6V battery (4-1.5v AA cells) drops to approximately 3.5v. In the case of alkaline batteries this will indicate approximately 1.5 hours of remaining operation.

HOLD TONE INDICATOR: A legend located in the lower right quadrant of the display. A LCD rectangle will illuminate behind the legend whenever the appropriate level and frequency single tone is present on the receive pair. This tone, called a holding tone, is necessary for making notch noise and S/N ratio measurements. The appropriate hold tone is:

AM-44 or AM-42 : 1010HZ ± 10HZ ≥ -40 DBM

AM-42E or AM-44E : 825HZ ± 20HZ ≥ -40 DBM

* The Hold Tone Indicator operates in Notch Noise and S/N Ratio Measure Modes only.

D. CONTROLS

Controls on the AM-4 are divided into three color coded groups. These are:

BLACK (line controls): Associated with configuring the unit for the type of line to be measured.

YELLOW (send controls): Associated with selecting the desired signal generator (send) function and controlling the signal generator.

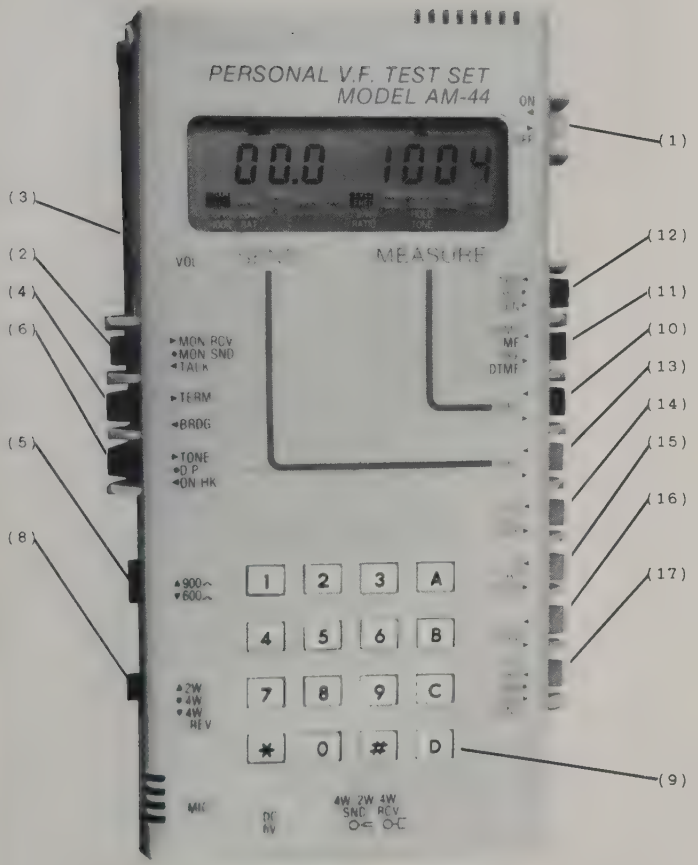
RED (measure controls): Associated with selecting the desired measurement function and measurement characteristics.

In addition to the above controls, the unit contains the following:

Power ON/OFF Switch: For turning the unit on and off.

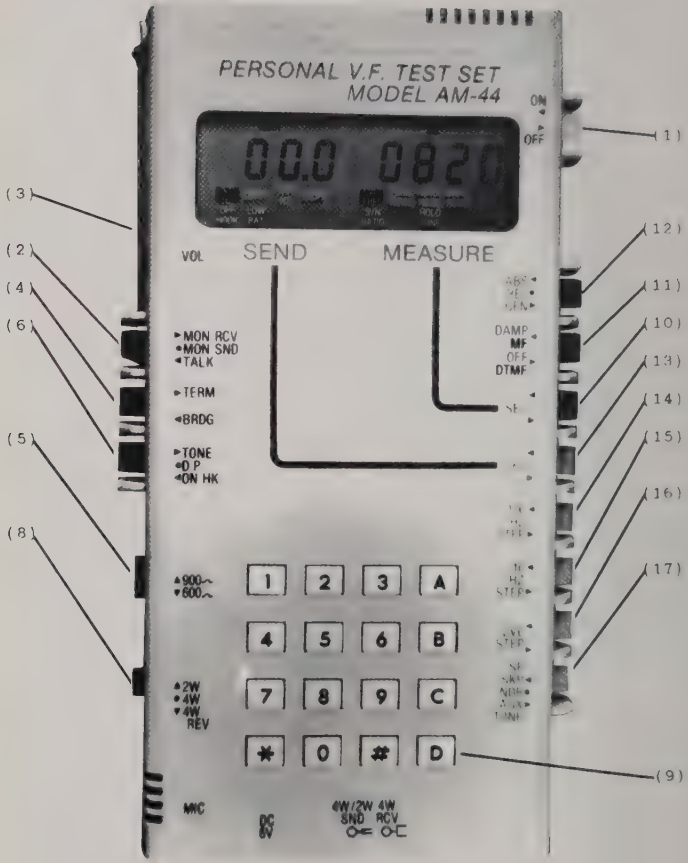
16 Button Keypad: To allow for sending of DTMF,MF or dial (AM44 & AM44E only) pulse digits, and/or for controlling Ameritec AM-3 Series Responders.

Speaker/Microphone: For "listening" on the send or receive pairs or for "talking" on the send pair.



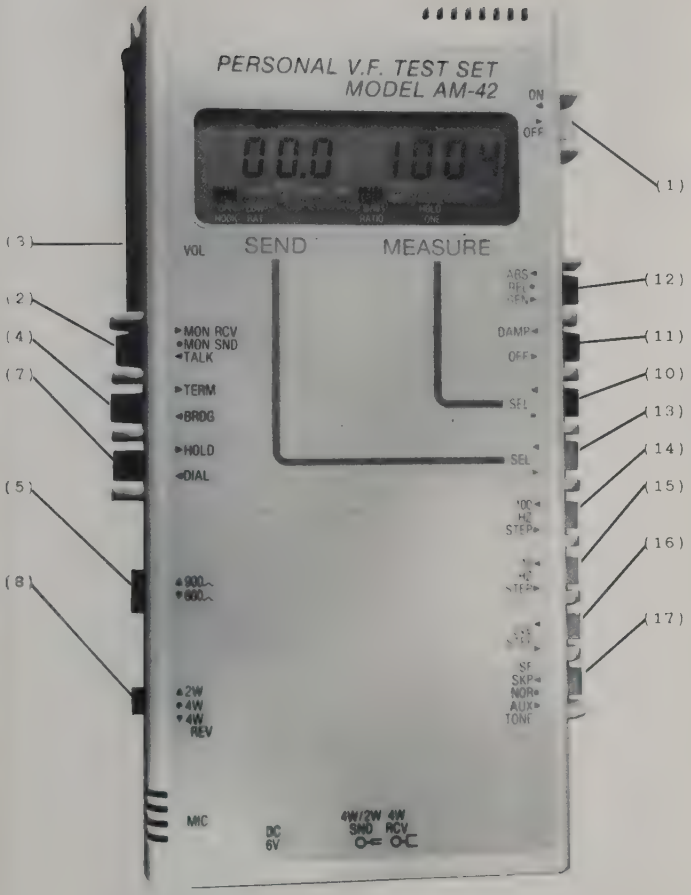
AM-44 CONTROLS & INDICATORS

FIGURE 1A



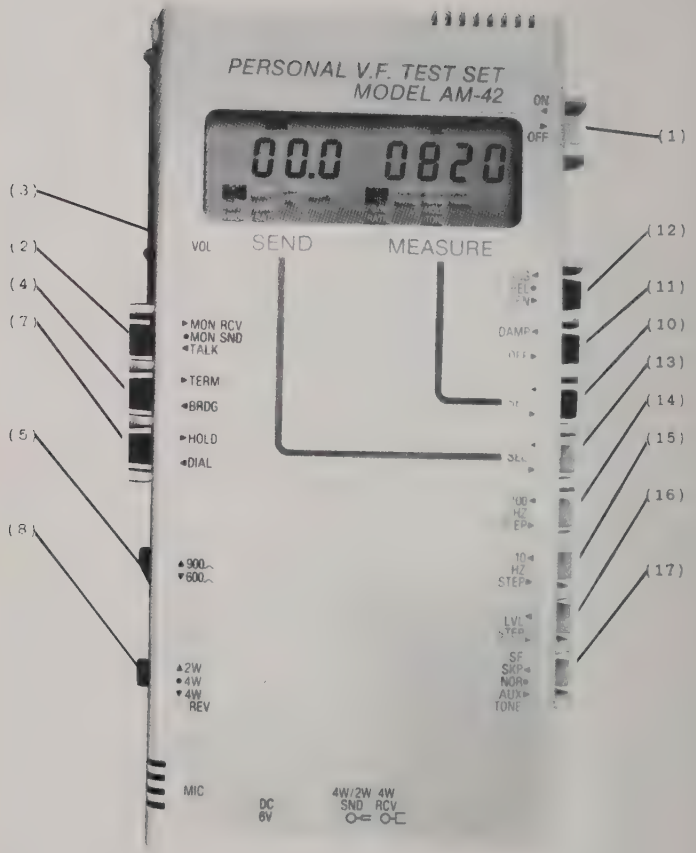
AM-44E CONTROLS & INDICATORS

FIGURE 1B



AM-42 CONTROLS & INDICATORS

FIGURE 1C



AM-42E CONTROLS & INDICATORS

FIGURE 1D

CONTROL	FUNCTION
(1) ON/OFF	POWER ON Depress "ON" switch once to turn unit fully on. NOTE: UNIT POWERS ON IN "LEVEL/FREQUENCY" MEASURE MODE, AND IN "QUIET" SEND MODE. POWER OFF Depress "OFF" switch once. (Unit will automatically turn off 16 minutes after last actuation of any rocker switch or key switch.) See Item (15) for Auto-Off override procedure.
(2) MON RCV/ MON SND/ TALK	MONITOR RECEIVE Connects the internal speaker MON to audibly monitor the receive pair. MONITOR SEND Connects the internal speaker to audibly monitor the send pair. TALK A momentary action (push to talk) position which mutes the speaker and connects the internal microphone to allow "talking" over the send pair. This feature is useful in voice communication with an assistant technician at the distant end of the transmission line being tested. It also allows the AM-4 to be used as a conventional push to talk telephone set on two-wire dial networks.
(3) VOL	VOLUME CONTROL Controls the gain of the internal speaker amplifier and allows the speaker loudness to be set to a comfortable level.
(4) TERM/BRDG	TERMINATE Causes the receive line to be terminated by a resistive impedance as selected by the 900 OHM/600 OHM switch. BRIDGE Causes the receive line to be unterminated and to be bridged only with the impedance of the measurement circuitry (>25K OHMs) across the receive pair. NOTE: In 2 wire mode the signal generator source impedance will cause the line to be terminated with 600 OHM or 900 OHM regardless of the position of the Bridge/ Terminate switch. If the "QUIET" send mode is selected while in two-wire bridge mode, the signal generator will be disconnected from the send pair and the send pair source impedance will be >25K OHMs. This will allow the Terminate/ Bridge switch to function.
(5) 600 OHM/ 900 OHM	600 OHM Applies 600 OHM across the receive pair when in the terminate mode and sets send pair source impedance at 600 OHM.

900 OHM Applies 900 OHM across the receive pair when in the terminate mode and sets send pair source impedance at 900 OHM.

(6) ON HK/DP/TONE (AM-44 & AM-44E)

ON HOOK causes a DC open condition across T & R of the send pair to simulate a telephone on hook condition on two-wire dial access lines. The 16 button keypad remains operational and if depressed will send out DTMF tones.

DIAL PULSE Causes a constant current (24 MA) DC short across T & R of the send pair to simulate a telephone OFF HOOK condition on two-wire dial access lines. Depression of a button on the 16 button keypad while in this mode will cause the DC short to make and break at 10 PPS, 60% break thus creating dial pulses in accordance with the button depressed.

TONE Causes a constant current (24MA) DC short across T & R of the send pair to simulate a telephone off hook condition on two-wire dial access lines. Depression of a button on the 16 button keypad will cause the appropriate DTMF or MF tone pair depending upon the setting of the DAMP (MF)/OFF (DTMF) switch.

16 BUTTON KEYPAD	MF (HZ)	DTMF (HZ)
1	700/900	1209/697
2	700/1100	1336/697
3	900/1100	1477/697
4	700/1300	1209/770
5	900/1300	1336/770
6	1100/1300	1477/770
7	700/1500	1209/852
8	900/1500	1336/852
9	1100/1500	1477/852
* (KP)	1100/1700	1209/941
0	1300/1500	1336/941
# (ST)	1500/1700	1477/941
A (ST3P)	700/1700	1633/697
B (STP)	900/1700	1633/770
C (ST2P)	1300/1700	1633/852
D	-	1633/941

(7) HOLD/DIAL (AM-42 & AM-42E units only)

DIAL Causes a DC open condition across the T & R of the send pair. In this position an external telephone set or butt-in test set may be connected in parallel with the AM-42 or AM-42E to accomplish line seizure (off hook) and dialing.
HOLD Causes a constant current (24 MA) DC short across the T & R of the send line and allows the external telephone set or butt-in test set to be disconnected while continuing to hold the line seized (off hook).

(8) 2W/4W/ 4W REV

2 WIRE. In this position the internal measurement circuitry and signal generator are connected together across the 2 wire line at the send jack and the signal generator source impedance of 600 or 900 OHMs terminates the line in all signal generator modes except quiet. In quiet mode the line will be terminated only if the terminate/bridge switch is in terminate position. The receive jack is not used when connecting to 2 wire circuits.

4 WIRE In this position the internal measurement circuitry is connected to the receive pair and the internal signal generator is connected to the send pair.

4 WIRE REVERSE In this position the send and receive pairs are reversed.

(9) KEYPAD (AM-44 & AM-44E)

A full 16 character touch tone keypad (including digits A, B, C, and D). Depression of a key will cause the signal generator to automatically go to QUIET mode and the appropriate DTMF (or MF) signal to be applied to the send pair.

NOTE: The keypad will generate DTMF or MF when the "DP/ON HOOK/TONE" switch is in either "ON HOOK" or "TONE" positions. It will generate dial pulses (open and close the DC short across T & R send pair) when in "D.P." position.

To restore the signal generator after sending TONE, operate the SEND SEL rocker switch.

(10) (MEASURE) SEL

MEASURE SELECT Causes the measure LCD cursor to be moved left or right across the LCD measure menu to allow selection of the desired measure mode.

(11) DAMP/OFF

OFF Causes the LCD level and frequency display to be updated at the rate of five times per second. This is considered the normal mode of display update as it allows rapidly changing readings to be followed.

DAMP Causes the LCD level and frequency display to be updated at the slower rate of two times per second and is useful in capturing erratic measurements.

MF/DTMF (AM-44 & AM-44E)

MF Allows the keypad to generate multi-frequency tones when the ON HK/DP/TONE switch is in the ON HK or TONE positions.

DTMF Allows the keypad to generate DTMF(touch TONE) when the ON HK/DP/Tone switch is in the ON HK or TONE positions.

(12) ABS/REL/ GEN

ABSOLUTE Causes the LCD to display the absolute value of the measurement made on the signal appearing on the receive line. Appropriate units of measurement are indicated above the measured values.

RELATIVE Causes the LCD level measurement to be zeroed relative to the last reading which appeared when the switch was moved from ABS to REL. Once in relative mode all subsequent measurements of level signals on the receive line will be displayed in dB "Relative" to the last absolute measurement. Frequency measurements will continue to be displayed in absolute HERTZ Values.

The relative mode is useful in making gain slope attenuation distortion measurements on a line as the signal generator is stepped thru the voice band.

GENERATOR Causes the LCD level and frequency display to indicate the value of the signal being applied to the send pair by the AM-4 internal signal generator. The level value is in DBM and assumes that the send line is properly terminated by 600 OHM or 900 OHM as selected by the 600 OHM/900 OHM switch.

(13)(SEND) SEL

SEND SELECT Causes the send LCD cursor to be moved left or right across the LCD send menu to allow selection of the desired send mode.

(14) 100HZ STEP

100HZ STEP Is used when the internal signal generator is in the VAR HZ (Variable HZ) mode to step the generated frequency up or down in 100HZ steps. Each depression of the top or bottom of this switch will cause the frequency to increase or decrease in 100HZ steps. Holding the key down will cause the frequency to auto step at 5 steps per second after a one second delay.

When the signal generator is in "Quiet" mode this control may be used to momentarily generate 5004HZ (top of switch depressed) or 2804HZ (bottom of switch depressed). (AM44E & AM-42E generates 3004HZ and 2004HZ instead of 5004HZ, 2804HZ).

(15) 10HZ STEP

10HZ STEP Is identical to the 100HZ step control except that it moves the generator frequency up or down in 10HZ steps.

When the signal generator is in "Quiet" mode this control may be used to momentarily generate 1004HZ (top of switch depressed) or 404HZ (bottom of switch depressed). (AM-44E & AM-42E generates 820HZ and 304HZ instead of 1004HZ, 404HZ).

NOTE: Controls 14 & 15 allow the generator to be set at any frequency in the 204HZ to 5004HZ band in steps of 10HZ.

AUTO TURN OFF TIME OUT — The 10HZ step and 100HZ step switches depressed simultaneously will cause the 16 minute auto shut off feature to be disabled. The feature is automatically re-enabled upon power on.

(16) LVL STEP — LEVEL STEP Is used when the signal generator is in any generate mode (except quiet) to step the signal generator output level (level applied to the send line) up or down in .1 dB steps. This control allows the generator output level to be set anywhere between -50 dBm to +10 dBm (0 dBm max for P/AR). Holding the key down will cause the level to AUTO STEP In 1dB steps. Momentary depression will move the level in .1dB steps.

(17) SF SKP/ NOR/ AUX TONE — SIGNALING FREQUENCY SKIP If the internal generator is in the VAR HZ mode and is being stepped thru its frequency range by the operator, this control in the SF SKP position will cause the internal generator to skip over the frequency band 2454HZ to 2754 HZ (models AM-44 and AM-42) or 2130HZ to 2430HZ (model AM-44E and AM-42E) thereby avoiding the accidental transmission of signaling frequencies.

NORMAL Allows the internal signal generator to be stepped through all frequencies within its range while in the VAR HZ mode.

AUXILIARY TONE Is a momentary press to actuate position which, when depressed, causes the internal signal generator to be over-ridden and a 2713HZ signal sent out in its stead. This feature is useful for actuating remote Western Electric Model 829 Loopback Units.

E. CONNECTIONS

Two alternate methods of line connection to the unit are provided: A dual miniature (bantum) jack and an RJ11 "modular" telephone line connector. These connectors are wired in parallel as shown in FIGURE 2.

When using the Model AM-42 or AM-42E on 2 Wire dial access circuits it is necessary to connect an external telephone set or butt-in test set temporarily in parallel with the send pair. This may be easily accomplished by connecting the line under test to the send bantum jack and temporarily connecting the telephone set to the modular jack, or vice versa. This procedure is not necessary with the AM-44 or AM-44E sets as they feature a built in dial.

F. BATTERY INSTALLATION

AM4 Series Units are powered from four, internal, replaceable, size AA batteries. When new, each battery will furnish approximately 1.5 volts. As the batteries are wired in series, the unit operates from 6 VDC nominal. An internal DC to DC Convertor allows operation until the batteries have discharged to approximately 3 volts.

The unit is furnished with four, high quality, alkaline batteries which will provide approximately 8-12 hours of operating life before replacement. When the batteries have discharged to approximately 3.5 volts a "low battery" LCD annunciator will illuminate. This will indicate approximately 1 to 2 hours of remaining operating life.

Commercially available, AA size Nickel Cadmium (rechargeable) batteries may be used in the unit, but operating life will be reduced to approximately 4 to 6 hours due to the limited energy storage capacity of rechargeable batteries. Once discharged, the Nickel Cadmium batteries must be removed from the unit and charged in an external charger*. Due to the abrupt end of life discharge curve of Nickel Cadmium batteries the "Low Battery" indicator will only provide a few minutes of warning before end of operation.

*NOTE
See ADDENDUM on inside covers of this manual for operation instructions for the Ameritec NiCad Battery Charger (Model 24-0008).

It is recommended that only first quality batteries be used in the unit and the unit not be subjected to excessively high temperatures or battery chemical leakage may result. The warranty does not cover damage to the unit as a result of battery leakage.

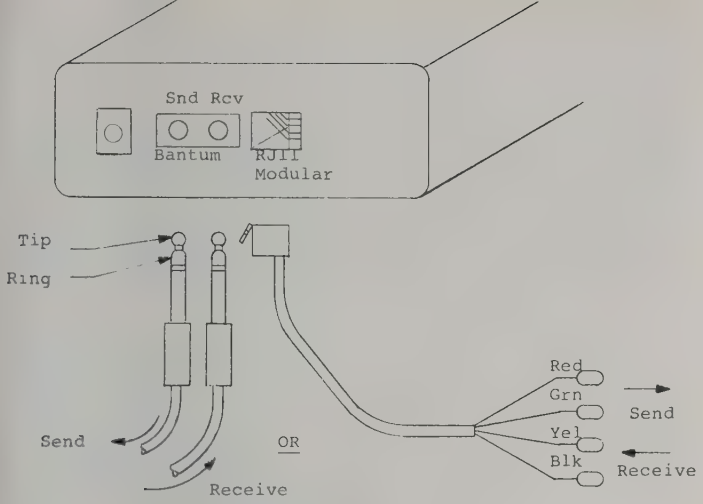
Install batteries as indicated in FIGURE 3.

G. BATTERY ELIMINATOR WALL TRANSFORMER

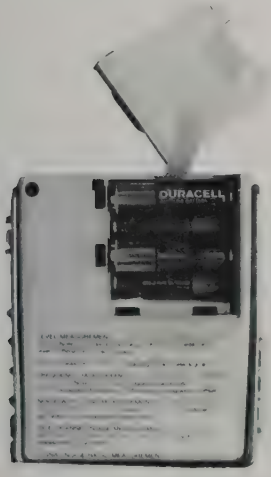
The unit is furnished with a battery eliminator wall transformer unit. The eliminator may be plugged into the "6VDC" Jack in the base of the unit to power the unit from AC mains and to conserve internal batteries.

Use of the eliminator will automatically disconnect the internal batteries.

NOTE: It is recommended that the battery eliminator wall transformer not be used when making low level noise measurements.



LINE CONNECTIONS
FIGURE 2



BATTERY PLACEMENT
FIGURE 3

V. OPERATION

A. END-TO-END TESTING (Figure 4)

Measurements on telephone transmission lines are usually made by applying an appropriate signal at one end of the transmission line and then measuring the results at the other end of the line. This approach requires an AM-4 Test Set at each end of the line as illustrated in Figure 4. This type of testing is known as end-to-end testing. While this type of testing is the most reliable for characterizing the near-to-far and far-to-near impairments which may exist, it has the obvious disadvantage of requiring two test sets and an operator at each test set to operate them.

B. LOOPBACK TESTING

A second less costly, although less reliable method of testing, is to loopback the distant end of the 4 Wire transmission line thru manual means or by using a simple commandable loopback device such as the Western Electric Model 829. Loopback testing has the advantage of requiring only a single test set at the central site and one operator However, its disadvantage is that it does not characterize transmission impairments in each direction. Instead an apparently satisfactory loopback measurement may contain impairments in each direction which cancel each other. This method of testing may be useful providing its limitations are recognized.

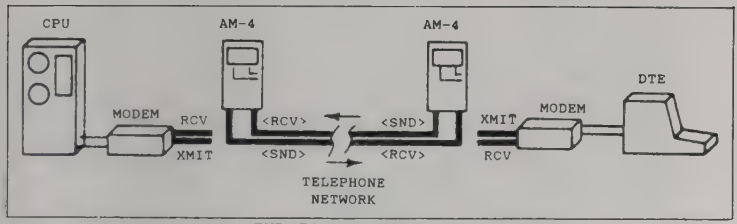
C. END-TO-END TEST WITH RESPONDERS (Figure 5)

A third method of performing transmission testing with most of the advantages of the end-to-end method, but without the disadvantage of duplicate test equipment, is thru the use of multifunction responders. This type of configuration is similar to loopback testing except that the responder contains signal generation capability in addition to loopback capability.

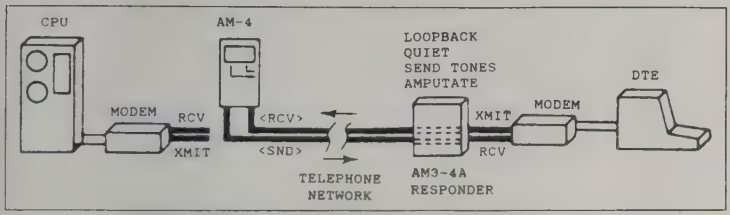
On 4 wire circuits a DTMF Commandable Responder, such as the Ameritec Model AM3-4A, may be placed permanently at the distant modem where it remains transparent until commanded by DTMF signals sent from the AM-4 unit at the central site. The responder can generate most of the signal generator functions normally generated by the AM-4 in addition to loopback, thereby enabling far to near tests as well as loopback tests. A typical responder testing configuration is illustrated in Figure 5.

D. DIAL NETWORK TESTING WITH RESPONDERS (Figure 6)

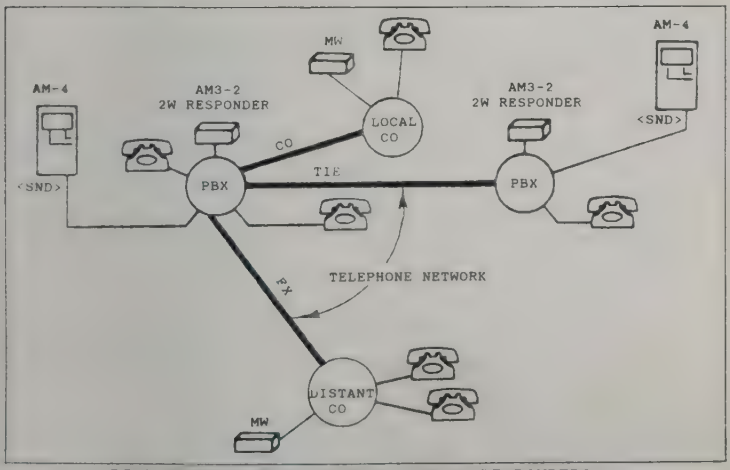
An AM3-2A may be dialed up over the network path under test using an AM-44 or AM-44E. It may then be commanded with touch tone from the AM-44 or AM-44E to make level measurements or send tones. A typical configuration is illustrated in Figure 6.



END-TO-END TESTING
FIGURE 4



END-TO-END TESTING WITH RESPONDERS
FIGURE 5



DIAL NETWORK TESTING WITH 2 WIRE RESPONDERS
FIGURE 6

VI. MEASUREMENTS

A. SET UP OF LINE TERMINATION IMPEDANCE

The AM-4 makes level and frequency measurements by measuring the voltage appearing on the line. The internal microprocessor then converts this voltage reading to dBm or dBrn by assuming that the line is terminated by either 600 or 900 OHMs as selected by the 600 OHM/900 OHM switch. The conversion is in accordance with the formula:

$$10 \times LOG_{10} (V^2 / Z/1000)$$

WHERE: Z = 600 or 900 OHMS

It is important that the line be properly terminated either by the AM-4 (AM-4 in terminate mode) or by some other device (such as a modem) of proper impedance with the AM-4 in bridge mode.

It is important that the 600 OHM/900 OHM switch be in the proper impedance selection even if the AM-4 is in bridge mode and the line is externally terminated, or a reading error of about 1.8 DB will result.

NOTE: The signal generator should be in "QUIET" mode when making measurements on 2 Wire circuits or the generator source impedance of 600 OHM or 900 OHM will terminate the line in addition to the external impedance and thereby distort the measurement.

If level or noise measurements are to be made on circuits externally terminated with an impedance other than 600 OHM or 900 OHM, see "IMPEDANCE ADAPTOR" on Page 29.

B. LEVEL (LOSS OR GAIN), AND FREQUENCY MEASUREMENT

Level or frequency measurements are made by applying a tone of a known frequency and amplitude (normally 1004HZ @ 0.0 dBm) to the distant end of the transmission line being tested and then measuring the received level and frequency at the near end. The difference between sent level and received level is the loss (or gain) introduced by the line. The difference in sent frequency and received frequency is the frequency offset introduced by the line.

Set Line Condition:		
TERM/BRDG	=	As Required
600 OHM/900 OHM	=	As Required
ON HK/DP/TONE or HOLD/DIAL	=	On Hook or Dial
2W/4W/4W REV	=	As Required
Set Send Condition:		
ABS/REL/GEN	=	GEN
SEND SEL	=	1004HZ @ 00.0 dBm (or 820HZ @00.0 dBm)

Set Measure Condition:

ABS/REL/GEN	=	ABS
MEASURE SEL	=	LVL/FREQ
DAMP/OFF	=	As Required

NOTE: It is important to place the ON HK/DP/TONE or HOLD/DIAL switch in the ON HK or DIAL position when operating on "dry" circuits when making measurements.

Observe Display for measured level and frequency.

SEE BELOW FOR SOME POSSIBLE CONFIGURATIONS TO MEASURE LEVEL AND FREQUENCY:

* End-To-End Testing (4 Wire or 2 Wire)
  Use an AM-4 at each end of the line under test (one to generate tone, the second to measure).

* Loopback Test with Western Electric 829
  Use one AM-4 at near end of 4 wire line under test. Momentary depression of Aux Tone Key will cause 2713HZ signal to be sent out on send line. This will trip the distant Model 829 into loopback and allow the transmitted tone to be returned for measurement. A second depression of the Aux Tone Key will cause the Model 829 to restore to normal.

* Responder End-To-End Testing
  a. Connect AM-4 to near end of 4 wire facility with Ameritec Model AM3-4A Responder at distant end.

  b. Use keypad to send appropriate DTMF command sequence to command responder into milliwatt mode (responder will generate 1004HZ or 820HZ, 0dBm signal). Measure received signal and note level and frequency.

  c. Use keypad to send DTMF command sequence to command responder into loopback.

     Use AM-4 to send 1004HZ (or 820HZ) @ 0dBm signal and measure loopback received level and frequency.

     Use keypad to send DTMF command sequence to restore responder to normal.

C. C-MESSAGE NOISE, PSOPHOMETRIC NOISE OR 3KHZ NOISE MEASUREMENTS

These noise measurements are known as idle channel noise measurements in that they are noise measurements made thru an internal shaping filter on a line under test without tone present. In fact, the distant end of the line being measured is normally "Quiet Terminated" (disconnected from the distant modem or terminal and connected to a resistive termination).

Set Line Condition:

TERM/BRDG	=	As Required
600 OHM/900 OHM	=	As Required
ON HK/DP/TONE or HOLD/DIAL	=	ON HK or DIAL
2W/4W/4W REL	=	As Required

Set Send Condition

ABS/REL/GEN	=	GEN
SEND SEL	=	Quiet

Set Measure Condition

ABS/REL/GEN	=	ABS
MEASURE SEL	=	C-MSG, PSHO or 3KHZ NOISE
DAMP/OFF	=	As Required

Observe display for noise level.

D. NOTCH NOISE MEASUREMENTS (NOISE WITH TONE)

A notch noise measurement is made with a holding tone of a specific frequency (normally 1004HZ in North American version, 825HZ in CCITT version) applied to the distant end of the line under test. At the near end of the line, the AM-4 test set routes the received signal thru a C-message or Psophometric filter and then passes the remaining noise through a notch filter to remove the holding tone before measuring the noise.

In order for the measurement to be accurate it is important for the received holding tone to be of the proper frequency and of adequate amplitude. A "Hold Tone" indicator is provided in the AM-4. If it is illuminated, the hold tone is of an acceptable frequency and level to insure an accurate measurement. If the hold tone indicator is not on the measurement is invalid. See "NOTES ON HOLDING TONE TESTS" on Page 33 for more information.

Set Line Condition:

TERM/BRDG	=	As Required
600 OHM/900 OHM	=	As Required
ON HK/DP/TONE or HOLD/DIAL	=	ON HK or DIAL
2W/4W/4W REL	=	As Required

Set Send Condition:

ABS/REL/GEN	=	GEN
SEND SEL	=	1004HZ @ 0 dBm or (825HZ @ 0 dBm)

Set Measure Condition:

ABS/REL/GEN	=	ABS
MEASURE SEL	=	NOTCH NOISE
DAMP/OFF	=	As Required
HOLD TONE	=	ON

Observe noise level in display. (Frequency display will display frequency of hold tone).

E. SIGNAL-TO-NOISE (S/N) RATIO TEST

This test is also performed by applying a holding tone to the distant end of the line under test. An AM-4 unit at the near end may be set to measure the level of the received signal (hold tone), remember its value, measure the residual noise after notching out the holding tone and then displaying S/N ratio as the difference, in dB, of the two readings. This simultaneous measuring and display of the difference is an automatic feature of the AM-4. Note that if the noise component is largely independent of the hold tone signal level then the S/N ratio will vary with the level of the transmitted hold tone. For this reason it is important that the transmitted hold tone level be set at the same level as the normal signal which appears on the line. See "NOTES ON HOLDING TONE TESTS" on Page 33 for more details.

Set Line Condition:

TERM/BRDG	=	As Required
600 OHM/900 OHM	=	As Required
ON HK/DP/TONE or HOLD/DIAL	=	ON HK or DIAL
2W/4W/4W REL	=	4W

Set Send Condition:

ABS/REL/GEN	=	GEN
SEND/SEL	=	1004HZ @ 0 dBm (820HZ @ 0 dBm or normal signal send level

Set Measure Condition:

ABS/REL/GEN	=	ABS
MEASURE SEL	=	S/N Ratio
DAMP/OFF	=	As Required
HOLD TONE	=	On

Observe S/N ratio in display. (Frequency display will display frequency of hold tone.)

F. P/AR MEASUREMENTS

P/AR (Peak to Average Ratio) measurements are made by applying a special 16 tone signal at the distant end of the line under test. At the near end the AM-4 is used to simultaneously measure the peak value and average value of the received test signal. The ratio of the Peak value to the Average value of the transmitted signal is arbitrarily assigned a value of 100. If the transmission channel were non-dispersive, then the received Peak to Average Ratio will also have a value of 100. A typical telephone channel does cause smearing or Intersymbol Interference and so a value other than 100 would be observed. Table 1 shows some typical values which might be used to judge the acceptability of a telephone line to transmit data reliably. For example: if a modem requires a C2 conditioned line and you measure P/AR of 50 then you know you are going to have difficulties. On the other hand, a value of 78 indicates that Intersymbol Interference will not trouble you.

TABLE 1
P/AR Requirements of Telephone Lines

CIRCUIT CONDITIONING	TYPICAL P/AR VALUES
BASIC CHANNEL	45
C1	48
C2	78
C4	87
C5	95

The P/AR value of the received (distorted) signal is made according to the following formula:

$$P/AR = 100*(K\ P/Afw\ -1)$$

Where: P = peak voltage of received signal
Afw = full wave average of the received signal
K = a constant

The constant K is derived by giving undistorted signal a nominal value of 100. Therefore:

$$K = 2Afwo/Po$$

Where Po = Peak voltage of the undistorted (original) signal
Afwo = full-wave averageof the undistorted (original) signal

Therefore:

$$P/AR = 100 * (2(P/Po)/(Afw/Afwo)-1)$$

or $$P/AR = 100 * (2(Pn/Afwn)-1)$$

Where Pn = normalized peak voltage of the received signal
Afwn = normalized full-wave average of the received signal.

P/AR is most sensitive to envelope delay distortion and return loss problems. To a lesser degree it is affected by attenuation distortion, noise, and nonlinear (intermodulation) distortion. It is basically unaffected by transient phenomena such as impulse noise and phase and gain hits.

There is high correlation between measured P/AR values and values calculated from a plot of envelope delay distortion. In fact, for an envelope delay response containing significant ripples, P/AR is a better indication of the network's ability to pass data reliably. Return loss problems are a common source of envelope delay ripple.

Noise can have a significant effect on a P/AR measurement. For this reason, it is important to measure signal to noise ratio (or noise-with-tone) before making a P/AR measurement.

If the signal-to-noise ratio is less than 25 dB, then the P/AR reading will be significantly reduced by noise alone.

Nonlinear (Intermodulation) Distortion can similarly affect the P/AR reading. The effect depends on whether the second or third order products dominate as the source of distortion. If the third order products dominate, they increase or decrease the P/AR value, depending upon the sign of the added products.

G. GAIN SLOPE MEASUREMENTS

Gain slope (sometimes referred to as attenuation distortion) measurements are similar to a level frequency measurement except the level measurement is made at several different frequencies in order to determine the loss (or gain) on the line at different frequencies. Because it is desirable to express the difference in loss at different frequencies, this measurement is usually done on a relative level basis. The AM-44 and AM42, when in slope mode, will repeatedly send 10 second intervals each of 404HZ, 1004HZ, and 2804HZ. (300HZ, 820HZ, 2000HZ and 3000HZ in the AM44E and AM-42E).

The measured level is observed at the near end of the line as the tones are sequentially applied and the least loss and most loss readings are noted. Their difference is the gain slope of the line. Alternately, the lowest absolute reading may be noted and the AM-4 switched to RELATIVE at that time. The display will zero and all subsequent readings will be in DB relative to the absolute reading.

Set Line Conditions:

TERM/BRDG	=	As Required
600 OHM/900 OHM	=	As Required
ON HK/DP/TONE or HOLD/DIAL	=	ON HK or DIAL
2W/4W/4W REL	=	As Required

Set Send Condition:

ABS/REL/GEN	=	GEN
SEND SEL	=	Slope Tones @ 0 dBm

Set Measure Condition:

ABS/REL/GEN	=	ABS
MEASURE SEL	=	LVL/FREQ

Note absolute (dBm) level as unit cycles thru the slope tones. At the desired frequency flip the ABS/REL/GEN switch to REL and all subsequent level readings will be in dB relative to the last absolute reading.

H. 2 WIRE MEASUREMENTS

2 wire measurements are similar to 4 wire end to end measurements in that an AM-4 can be used at the distant end of the 2 wire line to send while a second AM-4 can be used to measure.

Looparound tests cannot be performed on 2 wire lines because of the inability to send and measure simultaneously on the same pair.

Dial access responders are very useful in measuring far to near characteristics on a 2 wire line. A simple automatic milliwatt responder such as the Ameritec Model AM3-2C can be used to perform far to near level and frequency, idle channel noise and noise with tone.

The Ameritec DTMF Commandable 2 Wire Responder, Model AM3-2A, can also perform far to near gain slope as well as near to far level.

Either responder may be dial up accessed with the built in keypad of the AM-44 or AM-44E. The AM-44 or AM-44E may also be used to command the AM3-2A Responder thru the use of DTMF (touch tone) commands.

VII. DIAL UP OPERATION WITH AM-44 OR AM-44E

Set Up as follows:

2W/4W/4W REL	=	2W
600 OHM/900 OHM	=	As Required
ON HK/DP/TONE	=	On Hook
TERM/BRDG	=	Term
MON RCV/MON SND/TALK	=	MON SND
SEND SEL	=	Quiet

Come off hook by moving ON HK/DP/TONE control to DP or TONE, as required. If DP is selected, place the TERM/BRDG switch in the BRIDGE position during dialing and back to TERM when making measurements.

The off hook indicator in the display should illuminate and dial tone should be heard. Dialing may now be accomplished by keypad keystrokes.

If an Ameritec Model AM3-2A DTMF Commandable Responder has been called it will automatically answer ringing and be open to DTMF commands. To send DTMF commands, move the ON HK/DP/TONE control to the TONE position, the MF/DTMF control to the DTMF position, and key appropriate commands.

If a person has been dialed, the operator may communicate with the person by depressing the talk key and speaking into the microphone. Release the talk key into the MON SND position to listen to the other person.

VIII. DIAL UP OPERATION WITH AM-42 OR AM-42E

Dial up operation with the AM-42 & AM-42E requires an external dial telephone or butt-in test set connected in parallel with the line connected to the AM-42 or AM-42E send jack.

Set Up As Follows:

2W/4W/4W REV	=	2W
600 OHM/900 OHM	=	As Required
HOLD/DIAL	=	Dial
TERM/BRDG	=	Bridge
MON RCV/MON SND/TALK	=	MON SND
SEND SEL	=	Quiet

Go off hook with external telephone set or butt in test set and wait for dial tone. Dial out and wait for connection to be completed.

Place HOLD/DIAL switch in HOLD position and the TERM/BRDG switch to TERM. This places a constant current DC short across the line to hold the connection while the external telephone set or butt in is removed and lets the AM-42 or AM-42E hold the line.

Disconnect the external telephone set or butt in test set. Measurements or talk/listen may now be accomplished with the AM-42 or AM-42E.

IX. IMPEDANCE ADAPTOR

A. GENERAL

The Impedance Adaptor (24-0005) is illustrated in Figure 7. It is an optional accessory used to match the AM-4 to:

1. Line impedances other than 600 Ohms or 900 Ohms or
2. 4-wire split impedances.

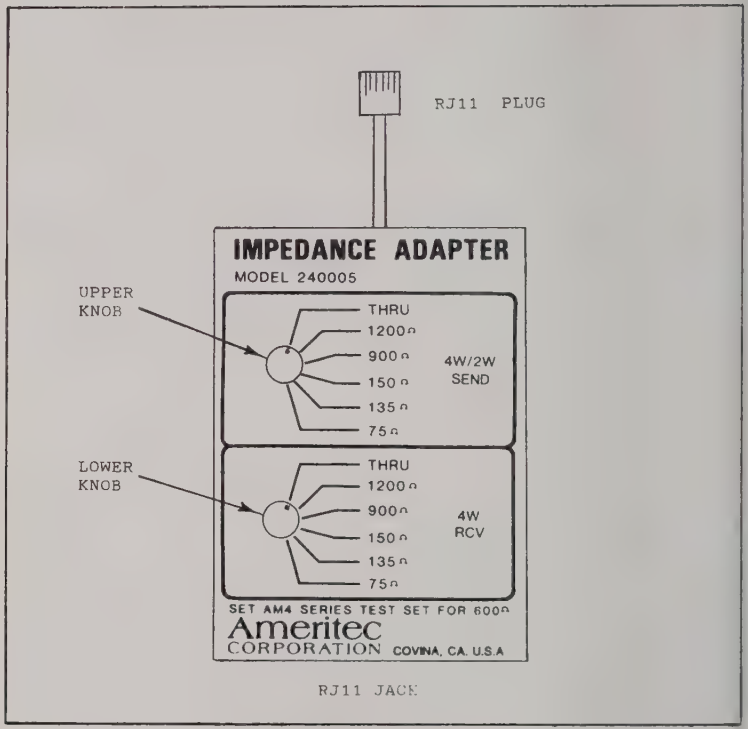
It plugs into the RJ11 modular connector of the AM-4. There are two (2) selector knobs to independently match the impedances of the send pair and receive pair lines. The dimensions of the impedance adaptor case are 2 3/4" x 2 1/8" x 1 1/4".

The Impedance Adaptor is used to match the AM-4 to impedances of 75, 135, 150 or 1200 Ohms. For example, high speed digital lines typically have impedances of 75, 135 or 150 Ohms. A "THRU" setting on the Impedance Adaptor makes a straight through connection resulting in a 600 Ohm termination inside the AM-4.

B. OPERATION

To use the AM-4 with the Impedance Adaptor:

1. Set 600 OHM/900 OHM switch to 600 OHMS and TERM/BRDG switch to BRDG.
2. Plug the Impedance Adaptor into the AM-4 modular jack.
3. Plug a modular line cable into the jack on the Impedance Adaptor.
4. Connect the line cable to the 2-wire or 4-wire line. See Figure 2.
5. Turn knob(s) on Impedance Adaptor to match impedance of the line:
   a. For 2-wire, use only the upper knob.
   b. For 4-wire, set the upper knob to match the Send pair impedance and the lower knob to match the Receive pair impedance.



IMPEDANCE ADAPTOR
FIGURE 7

C. IMPEDANCE ADAPTOR MEASUREMENT CORRECTIONS

IMPORTANT
When the line is connected to the AM-4 through the Impedance Adaptor, the display reading needs to be corrected.

Table 2 lists the correction values to add or subtract from the value on the display. To calculate the correct level on the line, add the correction value to a MEASURE level or noise display reading (ABS/REL/GEN switch in ABS or REL); subtract the correction value from a SEND level display reading (ABS/REL/GEN switch in GEN).

C. IMPEDANCE ADAPTOR MEASUREMENT CORRECTIONS, continued

TABLE 2
Impedance Adaptor Correction Values

IMPEDANCE ADAPTOR SETTING	CORRECTION VALUE
1200 OHM	3.0 dB
900 OHM	1.8 dB
THRU (600 OHM)	0 dB
150 OHM	6.0 dB
135 OHM	6.5 dB
75 OHM	9.0 dB

EXAMPLES. Refer to Table 2 for correction values (given in parentheses in the examples below).

1. Impedance Adaptor set to 135 Ohms.

   a. For AM-42 or AM-44:
   ABS/REL/GEN switch in ABS and MEASURE cursor at C-MSG NOISE. The display reads 60.0 dBrn.

   The correct reading is 60 +(6.5) = 66.5 dBrn

   For AM-42E or AM-44E:
   ABS/REL/GEN switch in ABS and MEASURE cursor at PSHO NOISE. The display reads -30.0 dBm.

   The correct reading is -30 +(6.5) = -23.5 dBm

   b. ABS/REL/GEN switch in GEN and SEND cursor at 1004 HZ (or 820 HZ). Level reading on display is -3.5 dBm.

   The correct reading is -3.5 -(6.5) = -10.0 dBm

2. Impedance Adaptor set to 1200 Ohms.

   a. ABS/REL/GEN switch in ABS and MEASURE cursor at LVL/FREQ. Level reading on display is -20.0 dBm.

   The correct reading is -20.0 +(3.0) = -17.0 dBm

   b. ABS/REL/GEN switch in GEN and SEND cursor at VAR HZ. Level reading on display is -3.0 dBm.

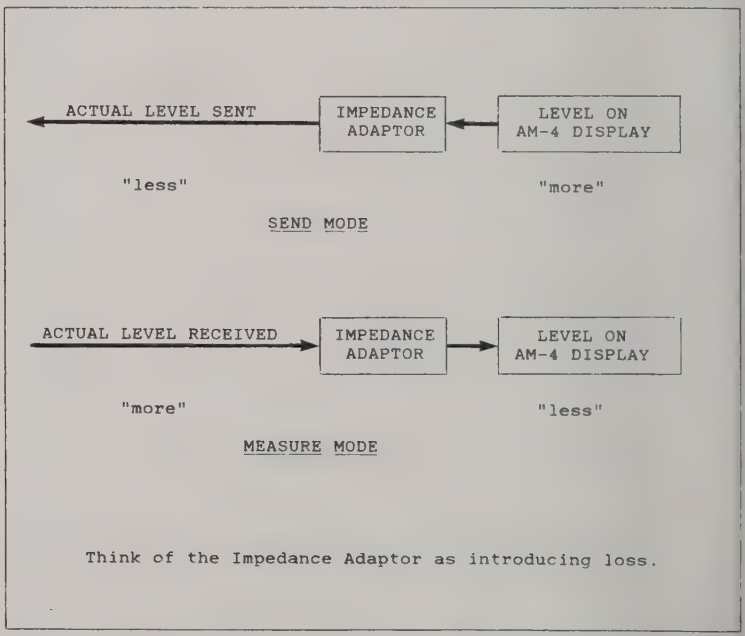
   The correct reading is
   -3.0 -(3.0) = -6.0 dBm

C. IMPEDANCE ADAPTOR MEASUREMENT CORRECTIONS, continued

Memory Aid. To remember whether to add or subtract the correction value, it is helpful to think of the Impedance Adaptor as introducing loss. The signal out of the Impedance Adaptor is thus "less" than the signal in. Refer to Figure 8.

For an AM-4 SEND mode, the signal actually sent on the line (beyond the Impedance Adaptor) is "less" than the signal sent from the AM-4 (as indicated on the display). The correction factor is thus subtracted from the display reading to give the actual level of the signal sent on the line.

For an AM-4 MEASURE mode, the signal received by the AM-4 (as indicated on the display) is "less" than the incoming level from the line. The correction factor is thus added to the display reading to give the actual level of the signal received at the line.



IMPEDANCE ADAPTOR CORRECTION VALUE MEMORY AID
FIGURE 8

D. IMPEDANCE ADAPTOR SCHEMATIC

Figure 9 is a schematic diagram of the Impedance Adaptor, Model Number 24-0005.

Note the following in the schematic of Figure 9:

1. The upper circuitry (2W or 4W Send) is identical to the lower circuitry (4W Receive).
2. Switch S1 is controlled by the upper knob of the Impedance Adaptor, Switch S2 is controlled by the lower knob.
3. Impedance Adaptor switch positions (THRU, 1200, 900, 150, 135, 75) are indicated on the upper poles of S1 and S2.
4. The internal impedance of the AM-4 is set for 600 Ohms. Therefore, for impedances greater than 600 Ohms, the Impedance Adaptor adds resistance in series to give the correct impedance. For impedances less than 600 Ohms, the Impedance Adaptor connects an appropriate resistance in parallel to give the correct impedance.

X. NOTES ON HOLDING TONE TESTS

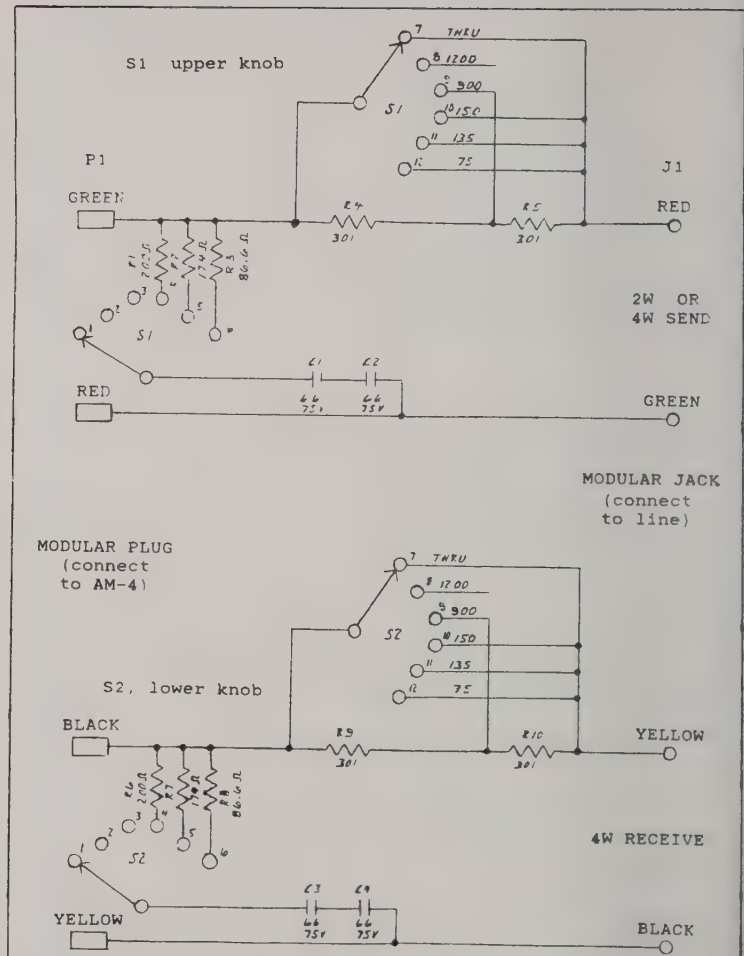
Purpose. These notes describe the proper method of making notched noise and/or signal-to-noise (S/N) measurements with any of the AM-4 series of products, including the "E" versions. By following these suggestions you will avoid situations where the unit can give erroneous results.

Holding Tone Requirements. The AM-4 products require the presence of a holding tone whenever a notched noise or signal-to-noise measurement is being made. The specifications for the holding tone are listed in Table 3. The holding tone level must be higher than the level of the background noise. If this tone is not present, the autoranging of the amplifiers in the unit will not function properly. The amplifiers can be driven into saturation, causing clipping, distortion, and improper readings. **THIS CAN ONLY HAPPEN WHEN THE HOLDING TONE IS NOT PRESENT.**

TABLE 3
Acceptable Holding Tone Ranges

MODEL	FREQUENCY RANGE	LEVEL RANGE
AM-42 or AM-44	995 Hz to 1025 Hz	+10 dBm to -40 dBm
AM-42E or AM-44E	800 Hz to 855 Hz	+10 dBm to -40 dBm

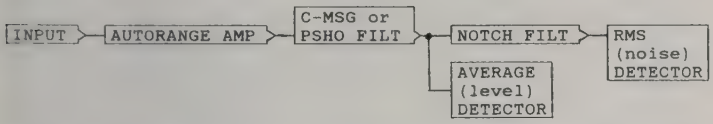
Incorrect and Correct Methods for Testing. The most common reason for the lack of holding tone seems to be when a user tries to measure the response curve of the combined C-MSG/NOTCH filter (PSHO/NOTCH filter for AM-42E and AM-44E) by taking measurements using a single frequency tone over the frequency range of interest; this will not work. The proper method for making such a measurement is to apply the sum of two signals, one being a holding tone, the other a variable frequency tone approximately



SCHEMATIC DIAGRAM OF IMPEDANCE ADAPTOR
FIGURE 9

Incorrect and Correct Methods for Testing, continued.
10dB lower in level. Two signal generators may simply be connected in series to produce the required signal. Then sweep the variable frequency tone over the desired range and note the NOTCHED noise readings relative to the level at which the tone has been set. Note that the depth of the notch filter can be most accurately measured by applying a very pure single frequency holding tone. The signal must have extremely low harmonic distortion, or the amount of distortion will be measured instead of the depth of the notch filter. The 1004 Hz holding tone from the AM42/AM44 (820 Hz holding tone from the AM-42E/AM-44E) is a satisfactory tone for this purpose.

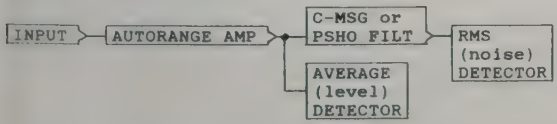
Technical Explanation. A simplified block diagram of the signal path used in notched noise and signal-to-noise measurement modes is shown below. The MEASURE menu cursor is set at either NOTCH NOISE or S/N RATIO.



The signal goes through the autorange amplifier, then through the C-MSG (or PSHO) filter. The output of the C-MSG (or PSHO) filter goes to the average detector used for measuring the signal level. It also goes through the notch filter to the RMS detector used for measuring the noise.

It is the signal level measured at the average detector that controls the gain of the autorange amplifier. Since the C-MSG (or PSHO) filter has 0 dB gain at the holding tone frequency, 1000 Hz (or 820 Hz), the average detector can measure the signal level properly as long as a holding tone is present. However, if a single frequency tone is applied at a frequency where the C-MSG (or PSHO) filter has considerable loss (such as above 4000Hz or below 300Hz), the average detector will measure a much smaller signal level than actually exists. In that case, the gain of the autorange amplifier will be increased until it saturates, clipping the signal, and introducing considerable harmonic distortion. The RMS detector will measure this distortion, giving noise readings much too high.

When measuring C-MSG (or PSHO) NOISE (without the notch filter) the signal path is shown below. In this case, the autoranging will function properly with any single frequency tone.



XI. TECHNICAL SPECIFICATIONS

PARAMETER	MODEL	SPECIFICATION
General		
Technology	ALL	Dual CMOS microprocessors, multi level PC boards in high impact injection molded case.
Measurements	AM44	Level (dBm or dB REL), frequency (Hz), Weighted Noise: C-MSG or C-MSG with notch (dBrnc) or 3KHZ flat (dBrn), S/N ratio (dB) and P/AR.
	AM42	Level (dBm or dB REL), frequency (Hz), Weighted Noise: C-MSG or C-MSG with notch (dBrnc) or 3KHZ flat (dBrn), and S/N ratio.
	AM44E & AM42E	Level (dBm or dB REL), frequency (Hz), Weighted Noise: Psophometric or Psophometric with notch or 3KHZ Flat (dBm), and S/N ratio (dB).
Dial	AM44 & AM44E	Built in 16 button keypad with hook switch and DTMF, MF or DP signaling selection.
	AM42 & AM42E	Dial/hold switch (for use with external dial).
Generator	AM44 & AM42	Sine wave tone generator variable in 100HZ or 10HZ steps from 204HZ to 5004HZ with or without SF skip. Level variable in .1 dB or 1dB steps from +10 dBm to -50dBm. Fixed tone presets for 1004HZ, P/AR (AM44 only), and slope (404HZ, 1004HZ 2804HZ). 2713HZ momentary override (for loop-back control). Momentary 404HZ, 1004HZ, 2804HZ, or 5004HZ available while in quiet mode.
	AM44E & AM42E	Sine wave tone generator variable in 100HZ or 10HZ steps from 204HZ to 5004Hz with or without SF skip. Level variable in .1 dB or 1dB steps from +10 dBm to -50 dBm. Fixed tone presets for 820HZ, and slope (304HZ, 820HZ, 2004HZ, 3004HZ). 2713HZ momentary override (for loop-back control). Momentary 304HZ, 820HZ, 2004HZ, 3004HZ available while in quiet mode.

SF Skip	AM44 & AM42	2450HZ to 2750HZ
	AM44E & AM42E	2130HZ to 2430HZ
I/O	ALL	4 wire (T R, T1 R1) or 4 wire reverse (T1 R1, T R) or 2 wire (T R) with dial loop hold.
Audio	ALL	Integral speaker with monitor receive/monitor send selector and integral microphone with push to talk.
Display	ALL	High contrast liquid crystal with simultaneous send and measure menu display, units of measurement display and data display.

Input

Impedance	ALL	Selectable, 600 OHM or 900 OHM balanced terminate or bridged (>25K OHM).
Line Hold	ALL	24ma nominal
DC Blocking	ALL	150VDC
Balance	ALL	> 60 dB
Return Loss	ALL	> 30 dB, 200HZ - 5kHZ

Level Measurements

Range	ALL	+10 to -64.9 dBm
Resolution	ALL	.1 dBm
Accuracy	ALL	
1004HZ (or 820HZ) 0 to -19.9 dBm:		± .1 dBm
200 - 5000 HZ, +10 to -40 dBm		± .2 dBm
100 - 9999 HZ, +10 to -64.9 dBm		± .5 dBm
Frequency Range	ALL	100 - 9999 HZ
High Frequency Noise Protection	ALL	2 pole Butterworth fco = 15kHZ (-3 dB)
Detector	ALL	Average value responding

Frequency Measurement

Range	ALL	50 - 9999 HZ
Resolution	ALL	1 HZ
Accuracy	ALL	± 1 HZ
Level Range	ALL	+10 to -40 dBm

Noise Measurement

Filters	AM44 & AM42	"C" message, "C" message with 1010HZ Notch (50 dB Min), 3 KHZ Flat
	AM44E & AM42E	Psophometric, Psophometric with 825HZ Notch (50 dB Min), 3KHZ Flat
Range	AM44 & AM42	10 to 99 dBrn
	AM44E & AM42E	-80 to 9 dBm
Resolution	ALL	1 dBrn or dBm
Accuracy	ALL	
20 to 70 dBrn (-70 to -20dBm)		± 1 dB
10 to 100 dBrn (-80 to +10 dBm)		± 2 dB
Detector	ALL	True RMS

Signal to Noise Measurement

Signal Level Range	ALL	+10 to -40 dBm
Noise Level Range	ALL	+10 to +70 dBrn (-80 to -20 dBm)
S/N Ratio Range	ALL	+10 to +50 dB
Accuracy	ALL	± 1dB

P/AR Measurement

Measurement Range	AM44	0 - 120 P/AR Units
Resolution		1 P/AR
Level Range		0 to -40dBm

Accuracy		± 2 P/AR Units 30 to 110 ± 4 P/AR Units 0 to 30 and 110 to 120

Signal Generator

Modes:

Variable	ALL	204HZ to 5004HZ in 100HZ or 10HZ steps
1004 HZ	AM44 & AM42	1004HZ
820 HZ	AM44E & AM42E	820HZ
Slope	AM44 & AM42	404HZ, 1004HZ, 2804HZ at 10 SEC each, continuously repeated.
	AM44E & AM42E	300HZ, 820HZ, 2000HZ, 3000HZ at 5 SEC each, continuously repeated.
P/AR	AM44	Complex waveform of 16 specific phase related frequencies.
Quiet	ALL	Disconnect SIG GEN from send line. (Momentary 404HZ, 1004HZ, 2804HZ or 5004HZ may be generated in this mode using HZ step controls). (304HZ, 820HZ, 2004HZ, 3004HZ for AM44E).
Aux Tone	ALL	2713HZ tone temporarily overrides any other signal generator mode.
Level Range	ALL	+10 dBm to -40 dBm
Level Resolution	ALL	.1 dB
Level Accuracy	ALL	± .2 dBm
Frequency Accuracy	ALL	± 1 HZ
Distortion	ALL	
1004HZ or 820HZ		<-55 dB
204 - 5004HZ		<-45 dB
Noise With Quiet Term		<10 dBrn (<-80 dBm)

Power

Batteries	ALL	Four 1.5v "AA" size alkaline batteries (furnished). 8-12 hours operating life, 9 hours nominal.
Ext. A/C Adaptor	ALL	6vdc nominal @ 1 watt (furnished)
Auto Shut-Off	ALL	16 minutes after last switch actuation. (May be overridden by simultaneous depression of 10HZ and 100HZ step controls.)

Environment

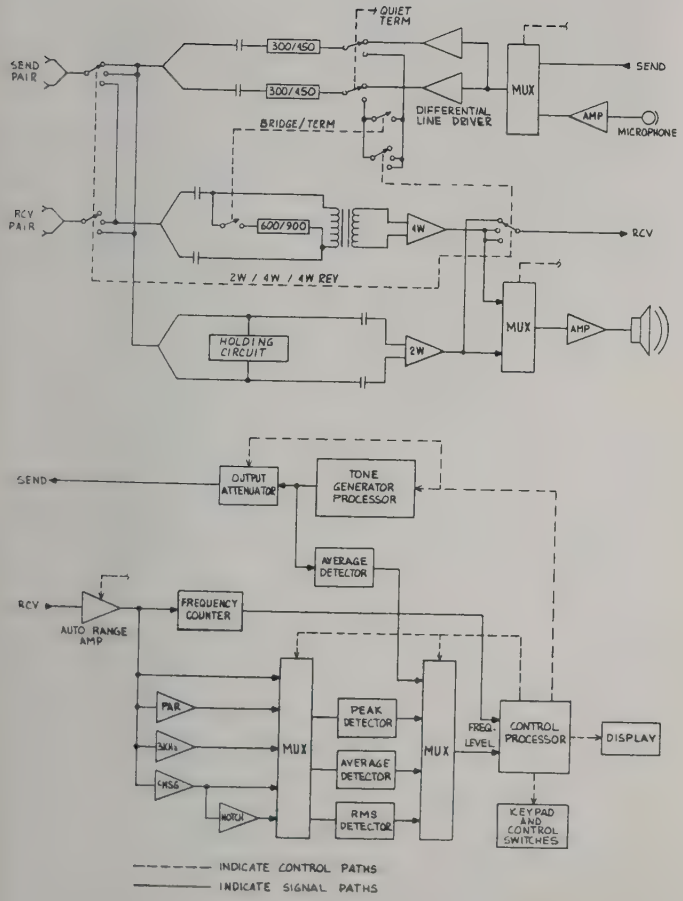
Temperature	ALL	
Operating		0° - 50° C
Storage (Less Batteries)		-40° - +75° C
Humidity	ALL	10 - 95% non-condensing
Atmospheric Pressure	ALL	5.5" - 30" mercury

Physical Characteristics

Size	ALL	4.2"w x 7.6"h x 1.7"d 106mm x 193mm x 43mm
Weight	ALL	26 oz including batteries
Connections	ALL	Dual Miniature Phone Jacks* and RJ11C Modular Jack.

(*Mates with Switchcraft TT253 or ADC PJ777 phone plugs .173" DIA)

Specifications are subject to change without notice.



SIMPLIFIED BLOCK DIAGRAM OF AM-44
FIGURE 10

WARRANTY AND SERVICE POLICY

WARRANTY

AMERITEC Corporation warrants that its electronic instrument products are manufactured to the highest commercial standards and are free from any defects in material or workmanship. For a period of one (1) year from shipment, AMERITEC will repair without charge to the original purchaser any unit which upon inspection by AMERITEC proves to be defective.

This warranty is the sole warranty offered by AMERITEC and is in lieu of all other obligations or liabilities, including claims of consequential damage.

SERVICE POLICY

In the event of a malfunction, call or write to the AMERITEC factory and obtain a return authorization number. Return the unit to AMERITEC, freight prepaid,with a note (in-warranty repair) or a Purchase Order for the repair (out-of-warranty repair) listing the following information:

- Return authorization number from AMERITEC.
- Return shipment address of purchaser
- Name and telephone number of person at purchaser's location familiar with the problem.
- Brief description of problem. (Include any printouts that may have a bearing on the problem, if possible.)
- Terms of payment of repair costs (out-of-warranty unit).

The unit will be repaired and returned freight-prepaid for units in warranty and freight-collect for out-of-warranty units. As stated above, a Purchase Order to cover the cost of repair must accompany any out-of-warranty return of the unit to AMERITEC.

AMERITEC CORPORATION
760 Arrow Grand Circle
Covina, California, 91722
U.S.A

Telephone: (818) 915-5441
FAX: (818) 915-7181

Issue 1: 4/19/91

EXTENDED WARRANTY PLAN
ORDER FORM

Extended warranty coverage of most Ameritec products is now available. The Plan can be purchased at any time, however it is most economical at the time of unit purchase. Although certain limitations exist, the Plan provides for the repair of hardware found to be defective while the Plan is kept in force. All repairs will be made at Ameritec's facilities by trained technicians. Ameritec personnel will assist each customer in diagnosing hardware problems. Unlimited telephone support is available as a part of the Plan.

The Extended Warranty Plan is available on a one year basis and is fully renewable. Ameritec will notify you of the Plan's availability approximately 60 days in advance of any warranty expiration. Ameritec has introduced two different Plans for each product. The Plans are defined as followed:

Plan 1: Ordered prior to the product being shipped, or during standard warranty or Plan coverage.
Plan 2: Standard new product warranty or previous Plan coverage has expired.

Subscription to the Plan is simple. **Complete each side of the following form and either mail or FAX it to Ameritec or your Ameritec representative.** You will be promptly notified of the start of coverage.

PRODUCT	PLAN 1 P/N	QTY	PRICE	EXT	PLAN 2 P/N	QTY	PRICE	EXT
AM 1 or AM 1E(not ISDN)	EW-0101	___	$1,100	$ ___	EW-0201	___	$1,800	$ ___
AM 1-ISDN or AM 1E-ISDN	EW-0102	___	$1,700	$ ___	EW-0202	___	$2,800	$ ___
AM 42 or AM 44	EW-0103	___	$450	$ ___	EW-0203	___	$700	$ ___
AM 48	EW-0104	___	$500	$ ___	EW-0204	___	$800	$ ___
AM 5 or AM 5XT-BASIC	EW-0105	___	$550	$ ___	EW-0205	___	$900	$ ___
AM 5XT	EW-0106	___	$700	$ ___	EW-0206	___	$1,100	$ ___
AM 7	EW-0107	___	$1,200	$ ___	EW-0207	___	$1,950	$ ___
AM 8	EW-0108	___	$800	$ ___	EW-0208	___	$1,200	$ ___

Prices: Subject to change without prior notice. **Terms:** Payable upon subscription.

	UNIT 1	UNIT 2	UNIT 3	UNIT 4
Model Type: (e.g.,AM1PLUS-11, AM 48, etc.) **Serial Numbers:**				
Options: (include separatly ordered line cards such as: 28-0055 for AM 7)				

USER AUTHORIZATION

Company: _____

Address: _____

Telephone: _____

FAX: _____

Name (print) : _____

Signature: _____

Title: _____

Date: _____

AMERITEC ACCEPTANCE

Signature: _____

Title: _____

Date: _____

ADDENDUM
NICAD BATTERY CHARGER, MODEL 24-0008

The Ameritec NiCad Battery Charger (24-0008) is an accessory to the AM-42, AM-44, AM-42E and AM-44E Personal V.F. Test Sets and is used to charge AA-size rechargeable NiCad Batteries.

IMPORTANT: READ THESE INSTRUCTIONS CAREFULLY. Unless NiCad Rechargeable Batteries are inserted in their module correctly, they will not recharge.

New NiCad batteries are not charged. They must be charged overnight in the charger before they will work properly. If not used for two months or more, they will tend to discharge. Follow the same charging procedure before using them again.

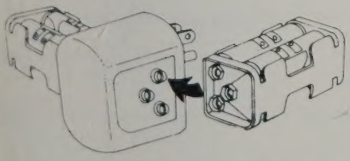
To insure a constant supply of charged batteries, keep an extra set charging continuously.

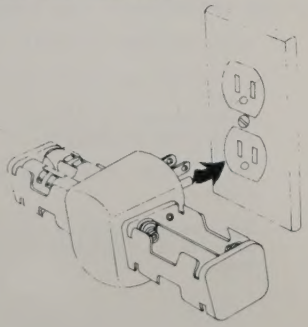
WARNING

Be sure to use only NiCad rechargeable batteries with the Battery Charger; DO NOT USE ALKALINE BATTERIES. Alkaline batteries can explode in a battery charger, damaging the batteries and the charger; Battery Charger warranty is voided if this happens.

OPERATION

1. Insert batteries into the module (make sure battery terminals are facing the right direction as indicated by arrows on inside of modules).
   When inserting batteries into modules, always be sure to insert bottom of battery into module first with top of battery inserted last to insure proper insertion, then spin batteries to insure contact.
   When only two AA batteries are used in the 4-position AA module, always make sure that they are inserted side-by-side in the same compartment, not in different compartments.
2. Snap the battery-loaded module into the charger.





ADDENDUM
NICAD BATTERY CHARGER, MODEL 24-0008

OPERATION, continued

3. Plug charger into any standard 110-120 volt household outlet. Batteries are ready to use after three (3) to five (5) hours in charger. They are fully charged in eight (8) to 12 hours.

4. Remove charged batteries. They are now ready to use. Batteries can be left on continuous charge if desired.

PROPER CARE OF CHARGER AND BATTERIES

* The charger may be wiped clean with a damp cloth, but only after removal from electrical outlet.

* Never immerse charger in water or other liquid.

* Try to recharge the batteries before they are completely discharged. This actually improves battery life and performance. In fact, NiCad batteries thrive on heavy use. The more you use them, the better they work.

* **DO NOT** put in fire or mutilate the batteries -- they may burst or release toxic materials. **DO NOT** attempt to short-circuit the batteries: this may cause burns.

* **DO NOT** use with ordinary throwaway batteries. They may burst, causing personal injury or damage.

* **DO NOT** expose to rain. Shock hazard may result.

* **DO NOT** attempt to attach 9-volt battery to charger. Mild shock can result.

IF THE BATTERIES DO NOT CHARGE PROPERLY AFTER INSERTION

* Check to see if household outlet is working.

* If outlet is connected to switch, be sure switch is on.

* Make sure batteries are facing in proper direction as indicated in module.

* Check both batteries and charger to make sure contacts are clean.

* If charger fails to operate, it may need professional servicing. Return it pre-paid postage to address on facing page.

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